

Name _____

STUDY GUIDE Chapter 13: RNA and Protein Synthesis

1. Explain 3 specific differences between the structure of DNA and RNA

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2. Which type of RNA

- Is an important component of ribosomes? _____
- Carries amino acids to ribosomes during protein synthesis? _____
- Carries copies of instructions from DNA to ribosomes? _____
- Contains codons? _____
- Contains anticodons? _____

3. The synthesis of RNA from a DNA template is called _____. The conversion of mRNA into the sequence of amino acids of a protein is called _____. In eukaryotes, transcription occurs in the _____ and translation occurs in the _____ at _____. _____ do not have a nucleus, so both transcription and translation occur in their _____.

4. The specific region of a gene where RNA polymerase binds and begins transcription is the _____. The enzyme _____ links RNA nucleotides using DNA as a template. The mRNA is synthesized in the _____ to _____ direction.

5. RNA's _____ pairs with DNA's guanine. RNA's _____ pairs with DNA's cytosine. RNA's _____ pairs with DNA's thymine. RNA's _____ pairs with DNA's adenine.

6. _____ are sequences of DNA that code for proteins, while _____ are not involved in coding for a protein. Therefore, after transcription, _____ are removed so that only the _____ remain to be translated. Also during RNA editing, a _____ is added to the 5' end of the RNA and a _____ is added to the 3' end.

7. A group of 3 nucleotide bases in mRNA that specifies a particular amino acid is called a/an _____. A group of 3 bases on tRNA that is complementary to mRNA and carries the appropriate amino acid is called a/an _____. All species use the same mRNA _____ to specify the same _____.

8. During translation, the _____ site within the ribosome holds the growing amino acid chain, while the next amino acid to be added to the chain is brought to the _____ site. _____ bonds form between adjacent amino acids to create a protein.

9. _____ proteins bind polypeptides and guide their folding. Misfolded proteins are refolded or dismantled at the _____. Protein _____ affects function! An example of a folding error is _____.

10. A change in the genetic material of a cell that alters a DNA sequence is called a/an _____. In point mutations, a _____ base pair in DNA is changed, generally during replication.

11. In a/an _____ one base is changed to a different base, resulting in the change of one codon. _____ mutations shift the reading frame of a genetic message, altering every amino acid that follows the mutation, so they tend to severely alter the resulting protein. However, if bases are inserted or deleted in multiples of _____, the reading frame is not altered. Two examples of frameshift mutations are _____ and _____.

12. Explain the difference between each of the following substitutions:

- Missense mutation
- Nonsense mutation
- Silent mutation

13. _____ are agents in the environment that interact with DNA and may cause a mutation by interfering with base pairing or weakening DNA strands. An example of a chemical mutagen would be _____, and an example of a physical mutagen would be _____.

14. Explain a harmful and a beneficial effect of mutations.

- Harmful:
- Beneficial:

15. _____ is a condition in which an organism has extra sets of chromosomes. Many mutations are neutral, because they may not even change any _____.

16. In prokaryotes, a group of genes that are regulated together is called a/an _____. The site where RNA polymerase binds to begin transcription is called the _____. The _____ lies between the promoter and the operon.

17. If the lac repressor binds to the operator, then the operon is turned _____. If lactose is present, it removes the repressor, turning the operon _____.

18. In eukaryotes, proteins that activate the transcription of certain genes are called _____. Gene regulation helps cells undergo _____, whereby cells become specialized. _____ genes regulate organs that develop in specific parts of the body. _____ genes code for transcription factors that activate genes important in cell development and differentiation.

19. Explain 3 ways transcription factors activate the transcription of certain genes:

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20. Name 3 environmental conditions that can also play a role in gene expression

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21. Given the following template strand of this DNA molecule, create the complementary strand of mRNA.

G-A-C-C-T-T-G-A-C

22. Given the following strand of mRNA, list the amino acids that create this protein.
(Use your decoder)

AUGGGCAACUUGCCU

_____, _____, _____, _____, _____

23. Given the following codons, write the complementary anticodons.

AAA CCC UAG GCA AUC

24. Given the following DNA sequence, determine the amino acids that will create the final protein product. (Hint: You have to translate the DNA to mRNA first and then use your decoder to determine the amino acid sequence.)

TACAATCGCATGCCA

_____, _____, _____, _____, _____

25. Given the following original DNA sequence, classify each of the following mutations as a *missense mutation*, *nonsense mutation*, *silent mutation*, *insertion*, or *deletion*.

Then, put a **STAR** next to the mutation that alters the reading frame.

You MUST show your work (transcription AND translation) below to get any credit!

Original DNA sequence: TACCTGACGGTGTTG

Mutation A: _____ TACCTGACTGTGTTG

Mutation B: _____ TACCTGACGGTGTTT

Mutation C: _____ TACCTGACGTTG

Mutation D: _____ TACCTAACGGTGTTG

Mutation E: _____ TTACCTGACGGTGTTG